Fishing Methods for the Indian Shad [*Hilsa ilisha* (Hamilton)] in the Indian Region

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PART I

(*With* 2 *text-figures and* 15 *plates*)

CONTENTS

INTRODUCTION

The Indian Shad, *Hilsa ilisha* (Hamilton), is one of the few fishes in the Indian region for which special types of nets and methods of fishing have been evolved and employed. The object of this article is to bring together the existing information on the fishing methods for this important food fish and to record the observations made on the subject in the course of my investigations on the fish and its fishery in India. The available information from the neighbouring countries of Pakistan and Burma is also incorporated for comprehensiveness and to facilitate comparison.

Among the existing records the most important are the accounts by Hornell (1924 *a*, 1950), wherein he has given information on the methods employed in the Cauveri in Madras, in the Ganges in Bengal, and the Indus in Sind, and by Kulkarni (1951) on the fishing methods in the Narbada in Bombay. In addition to the above, Naidu (1939) has given details of a number of fishing methods employed for hilsa

in Bengal and more recently Ahmad (1954) has briefly described the various hilsa fishing methods in East Bengal.

In this account the important hilsa fishing methods are described in detail while mention is also made of certain fishing methods which are of lesser importance and regarding which little has been published so far. A particular type of gear is described only once but modifications and variations, if any, observed in other zones are also mentioned under the respective zones. The various nets are classified under different heads like clap nets, gill nets, seine nets, etc. In certain cases a rigid grouping is not possible since the same net may be used in more than one way with some minor modifications. In such instances the fishing gear concerned is described in detail when first referred to. Illustrations are mostly semi-diagrammatic and are given wherever possible. A glossary of local names of fishing gear and tackle mentioned in the account is given at the end.

The same type of net is subject to variation from place to place and may even be known by different names. Two nets are seldom exactly alike even in one locality though the general pattern of construction will be the same. The mesh size given in the account is in the stretched condition unless otherwise stated. The ply number refers to the number of times the particular count of thread is twisted to make the twine used for the net.

Though no pains have been spared to collect as much information as possible from all available sources, the account is not claimed to be complete. Any additional information is welcome and it will be highly appreciated if any inaccuracies could be brought to my attention so that these may be rectified.

Considerable help has been received from a number of persons in effecting this compilation and this is acknowledged in the appropriate places. All the figures, except 5, 8 *b*, 19 *b*, and 22 which are after Ahmad (1954), Hornell (1950), and Kulkarni (1951), were drawn under my supervision and the names of the artists are given against the respective figures. I thank all of them for their co-operation and valuable assistance.

Hilsa Fishing Methods

I. INDIA

1. West Bengal

In no part of the Indian region do we find such a variety of fishing gear and tackle, particularly for hilsa, as in the deltaic region of the Ganges, lying in West Bengal and East Bengal in India and Pakistan respectively. This is obviously due to the presence of the

fish in this area in larger numbers than anywhere else, its availability practically all round the year, and the great demand for the commodity. While there are certain special kinds of nets operated primarily for hilsa, there are a number of multi-purpose nets in the catches of which this fish forms an important item in varying proportions.

Nets are made of either cotton or hemp and are used tanned or untanned. The tanning is done with a decoction of the fruits of *gab* (*Diospyros embryopteris* Pers.).

The fishing boats in Bengal are of the carvel type made locally of Sal (*Shorea robusta* Gaertn.) or Jarul (*Lagerstroemia flos-reginae* Retz.) and rarely of Teak (*Tectona grandis* Linn.) and are collectively called *jalia dinghis*, though most of them have their special local names based on the nets used.

Clap nets

Among the nets used for hilsa in the Indian region, the *shangla jal* and the *kharki jal* (Hornell 1924 *a* and 1950, and Nayudu 1939) which are both clap nets may be considered as the most specialised ones. The latter is a simpler form of the former and slightly smaller in size. Both are operated from May-June to September-October.

Kharki jal (Pl. I, fig. 1 *a*). This is a purse-shaped clap net which is so constructed and contrived as to effect its closure when desired. The frame of the net consists of two long slender arched bamboo pieces about 8 metres long tied together at both ends in the form of hinges. To this frame is attached a wide-meshed rectangular bag-shaped net having a mesh of 5 cm. to 10 cm. made of 7 to 10 ply 22 count cotton yarn about 2 metres deep. The net is said to be suspended in a horizontal position from a boat by two ropes but more often it is operated without side ropes just as the *kami jal* of Assam. The mouth is kept open with a vertical bamboo loosely passing through a ring in the upper lip and attached to the lower lip enabling it to be pushed down to the required extent. The boat is allowed to drift in the direction of the current with the mouth of the net facing downstream trapping any fish coming up. The entry of a fish into the net is felt through the bamboo which is pulled up bringing the two lips together and trapping the fish inside. Only one *kharki jal* is operated from a boat and a minimum of two persons are required for the purpose, one at the helm and the other in charge of the net. This net could be used only in the surface and sub-surface waters up to a depth of about 3 metres depending on the length of the pole.

Hornell (1950) says that it is of the 'same shape as that of the *toni jal* of Bogra from which it appears to be directly derived'. According to Ahmad (1954) the *toni jal* of East Bengal is a trawl

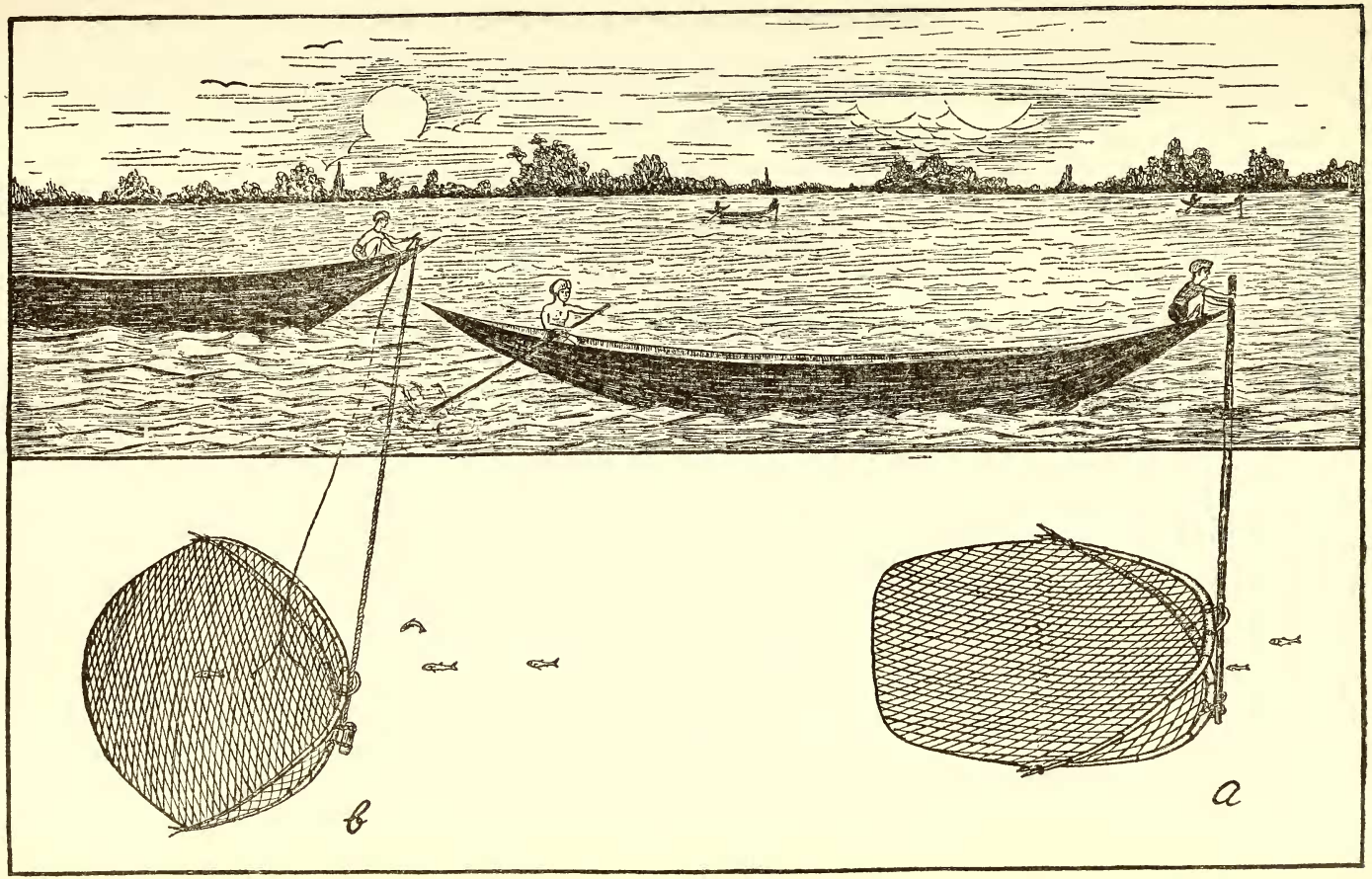

Fig. 1. a. *Kharki jal* of Bengal.
b. *Shangla jal* of Bengal. (By M. P. Lakshmanan)

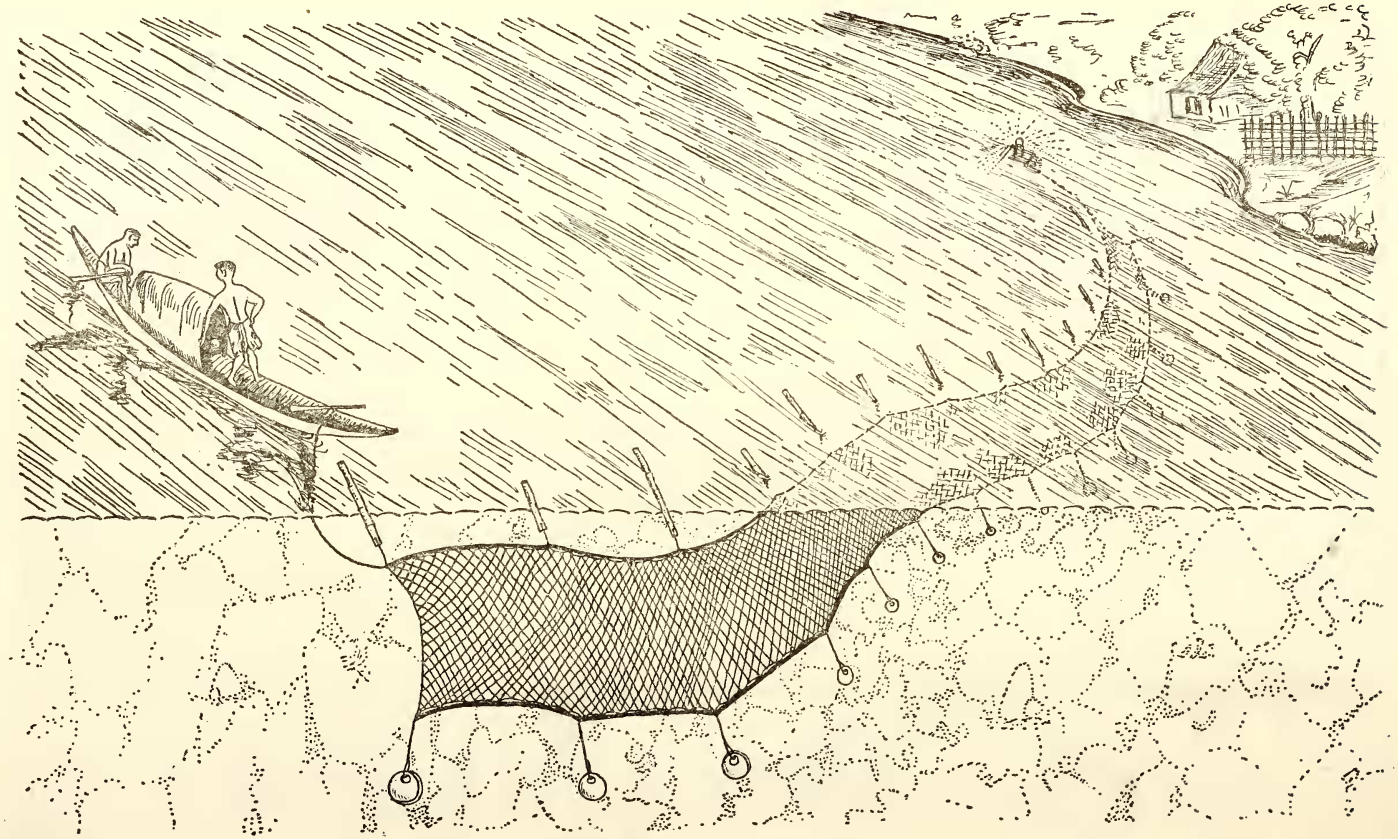

Fig. 2. *Chhandi jal* of Bengal. (By M. Mydeen Kunju)

net, about 3 to 9 metres in length and 2 to 5 metres in width having mesh from 0.3 to 2.5 cm. It is a bag-like net the mouth of which is kept open by floats and weights and is used throughout the year for catching small-sized fish. It would appear that there are two types of nets with the same name in East Bengal.

Shangla jal (Pl. I, fig. 1 *b*). This is an improved modification of the *kharki jal*. The net is generally slightly larger in size, with the bamboo lips thinner and the bag about 3 to 4 metres deep. It could be used from the surface to a depth of several fathoms. The bag portion is rounded unlike in the *kharki jal* in which it is rectangular. The netting is of cotton, 7 to 12 ply of No. 22 count and the mesh is from 8 to 11 cm. The mouth is kept open by a brick or stone weight of 8 to 10 kg. tied to the centre of the lower lip. There is a feeler cord fixed to the upper portion of the net to transmit the disturbance caused by the entrance of a fish into the net. The feeler cord is held in the left hand and the haul rope in the right. There are no balancing ropes as first shown in the figure by Hornell (1924 *a*) and reproduced in several subsequent publications. The stout haul rope is paid out to the desired depth so that the net remains suspended at about the subsurface or midwater region where according to the fishermen hilsa are present in appreciable numbers. When a single net is operated from a boat, it is suspended from the prow by a rope passing through a ring or Y-shaped piece of wood in the upper lip and attached to the middle of the lower lip immediately above the weight. Occasionally when the net is operated at very low levels it gets entangled in submerged obstructions and if efforts to extricate it are of no avail the rope is cut and the net abandoned. When two nets are operated simultaneously from a boat a minimum of 3 persons are required for the purpose, one at the helm and two others to operate the nets and assist in rowing. The boat is brought broadside to the current and the nets are shot from either end of the left side.

The boats used for operating both *shangla jal* and *kharki jal* are of the same type and are known as *dinghis*. A *dinghi* is a plank-built round-bottomed shallow boat most common in the Ganges, about 8 metres long and about 1 to 1.5 metres wide with long pointed bow and stern. The boat is strengthened by ribs and cross-beams with detachable half-split bamboo pieces in the interspaces. Long paddles are used which serve in steering. One or two spare bamboo poles are also kept in the boat. When sailing, a bamboo mast is carried in the front with thin split sail supported by a diagonal bamboo yard stepped far in front. A hood is not always used when fishing for hilsa, though there is provision for one at the far

aft. Those fishermen who seasonally migrate from distant places invariably fix one in their boats as it forms their living quarters during this period.

Gill nets

There are several kinds of gill nets, each differing from the other only in details. Some are of the drifting type, while others are fixed gill nets, and often the same net is known by two different names. The net proper may either be of cotton or hemp and tanned or untanned. Tanned nets are used in turbid waters and untanned nets in clear water. Some have sinkers while most of them have floats.

Chhandi jal (Pl. II, fig. 2.) This is a drift net and is used mainly for catching hilsa. The size of each piece varies considerably but generally each piece is about 10 to 12 metres long and about 2.5 metres broad with 6 to 10 cm. mesh. Nets used in deep areas may be over 8 metres broad. There is a thin head rope of hemp to which are attached bamboo floats at about 4-metre intervals and a stout ground rope of hemp to which are attached, by coir ropes (1 to 1.5 metres long), thick disc-shaped burnt-clay sinkers each of about 10 to 13 cm. in diameter having an eccentrically placed hole.

For operational purposes several pieces of net from 25 to 75 are tied together depending on the length required and the resources of the co-operating fishermen. To one end of the head rope a small raft of bamboo is attached and the net is paid out across the river, the other end being tied to a boat. The net as well as the boat drifts down in the current, gilling any ascending hilsa. When fishing is done at night a light is kept burning on the raft so that the men in the boat can get an idea of the position of the other extremity of the net. For day-time fishing, the raft is sometimes substituted by a long pole or any conspicuous floating object. *Chhandi jal* fishing is more often carried out at dusk or during the night when the migratory activity of hilsa is said to be at its maximum. Though the net is employed mainly for catching hilsa, other fishes also sometimes get gilled or entangled in it.

The boat used for the operation of this net is known as the *chhandi nauka.* This is a shallow plank-built boat with a rounded bottom, longer and wider than the dinghi. The stern is slightly higher than the prow and has decking throughout the length. The boat is provided with a hood and there is provision for a mast and sail. There are usually 6 to 9 persons in a boat. The net is generally used from April-May to September-October.

Ilish jal. This net, similar to the *chhandi jal* but of smaller mesh (5 to 8 cm.), is mainly employed for catching hilsa and is known as

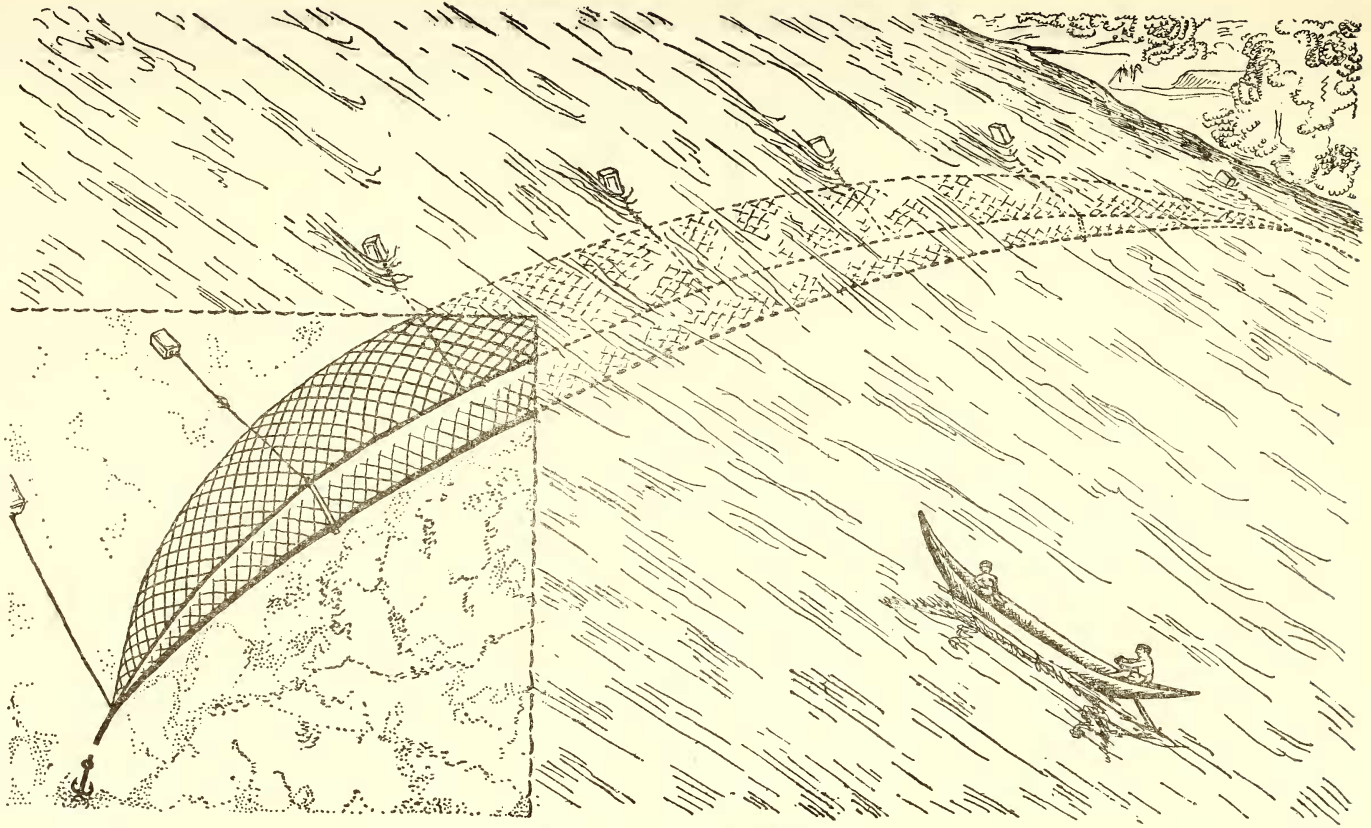

Fig. 3. *Konta jal* of West Bengal. (By M. Mydeen Kunju)

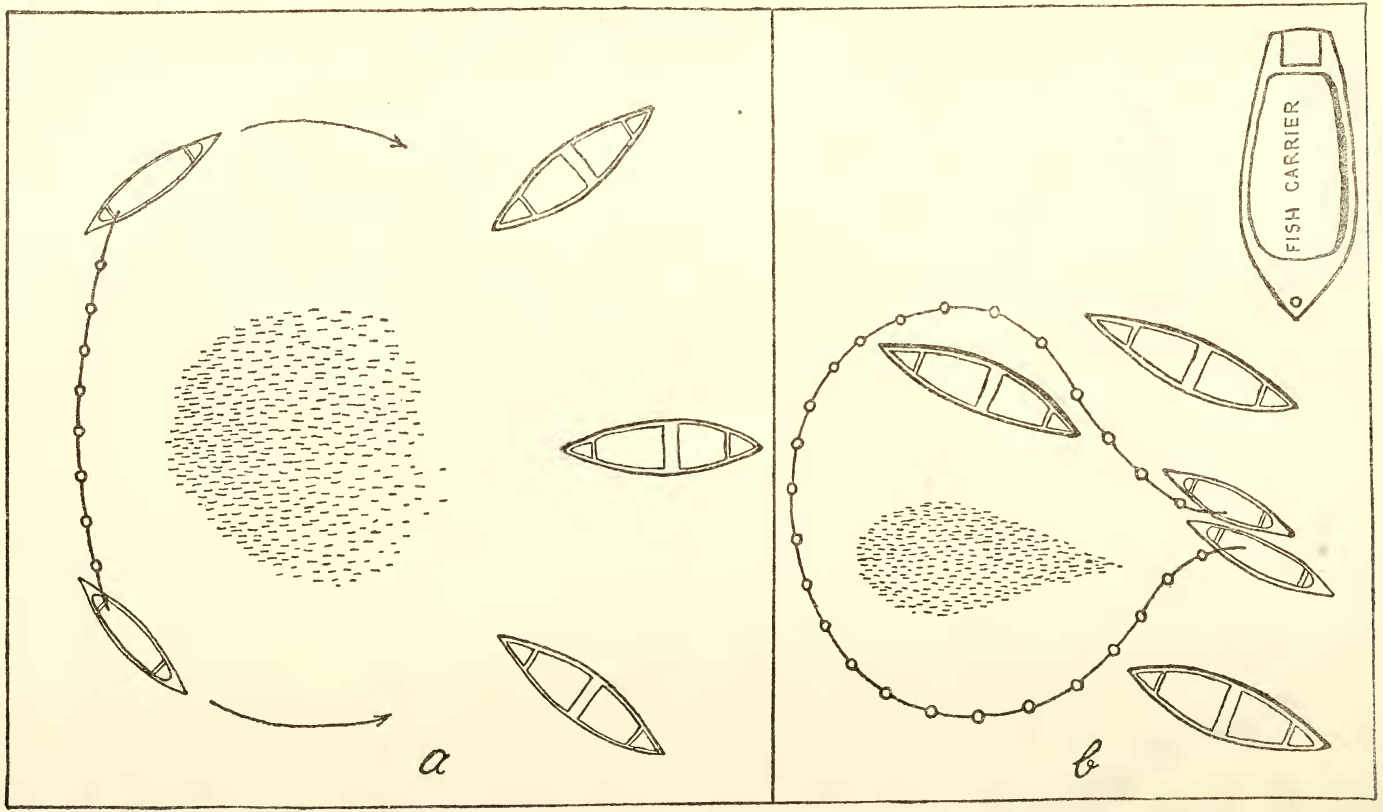

Fig. 4. Diagrammatic representation of the operation of *Kochal jal* of Bengal. (By M. Mydeen Kunju)
a. Beginning of the operation. b. End of the operation.

the *dora jal* also. The length varies from about 60 to over 300 metres and the depth from about 5 to 8 metres according to the width and depth of the river. The net is generally operated after the Pooja for a period of about 6 months from October-November to March-April and the hilsa caught is of comparatively smaller size than with the *chhandi jal*.

Two modified types of *chhandi jal* used for capturing hilsa are the *karal jal* in which there are no weights along the ground rope and the *Goolti jal* in which the lower portion is puckered and is provided with burnt elliptical-shaped clay sinkers. These are reported to be operated from May to October.

Konta jal (Pl. III, fig. 3). This is a fixed gill net used mainly for hilsa in the tidal regions. It is rectangular in shape consisting of 4 or more pieces, each 18 metres long and 8 metres deep, tied together to make an operational net. The net is made of cotton of 6 ply No. 10 thread and the mesh is about 5 to 8 cm. wide. The foot and head ropes are brought together at the extreme ends with a pair of bamboo poles each 4 metres long placed vertically to keep the net open. The net is stretched across the river and the two ends are tied to anchors, and a number of buoys in the form of kerosene drums are tied to the head rope. The current keeps the net distended like a bag and any large fish that tries to pass through it gets gilled. The fishermen inspect the net in a dinghi every one or two hours and collect the gilled fish. This net is generally operated from May-June to September-October.

Seine nets

Kochal jal (Pl. IV, fig. 4 *a*, *b*). Among the seine nets one that is used specially for hilsa is the *kochal jal*. It appears that similar nets probably with varying degrees of local modifications are used for hilsa fishing during the winter months along the Indo-Pakistan-Burma coast from Orissa to the Mergui Archipelago. In the Sundarbans of Bengal the *kochal jal* is used for large-scale hilsa fishing during the winter months from November to February. The net is made of cotton of 10 ply No. 20 or 22 count thread with about 8 cm. mesh towards the head rope and 10 cm. mesh towards the foot rope. Each piece has a length of about 12 metres and depth of 30 metres and about 22 such pieces are fastened together giving an over-all length of about 280 metres to make one operational unit. The middle piece of net is comparatively narrow, having a depth not more than half of the rest of the portion and is of stouter thread and smaller mesh (about 4 cm.). The head rope has wooden floats at regular intervals and the foot rope is stout and strong. A *kochal jal* fishing unit

consists of 5 or 6 boats with a complement of 5 men in each boat. For operational purposes two open dinghis sometimes smaller than the rest and connected to one another with a short length of rope are used as tender boats for carrying the net, stacked half in each. During the winter months when water in the estuaries and the foreshore areas of Bengal is calm, several hundreds of such fishing units wander about in search of hilsa shoals. As soon as a shoal is sighted the group disperses and makes an encircling movement, the two tender boats on one side of the shoal and the other boats on the opposite side. Before the shoal gets time to scatter the net is quickly paid off simultaneously from both the boats each describing an arc and the other boats converge towards the closing circle, the men in them making a mighty din by beating of poles, shouting, and striking on the water so as to scare the fish and drive them towards the nets. The two tender boats meanwhile close up bringing together the two ends of the net and drawing the foot rope of one side over the other, converting the whole net into an incomplete bag in which the fish get imprisoned. They are collected and transferred to the boats to be disposed off to the merchants who move about with supplies of ice in carrier boats to purchase the catches. A day's catch by a single unit by this method of fishing when large shoals are sighted runs to several scores of maunds whereas sometimes the men wander about for days or weeks together without catching a single fish.

Gai Ber jal. This is a very long rectangular seine net measuring 300 or more metres with puckerings in the lower portion. The simpler type of seine net without puckerings is known as *ber jal.* The net may be made of either cotton or hemp and the mesh varies from 1 to 5 cm. of 5 ply of 5 or 10 counts to 20 ply of 10 counts. The head rope and the foot rope are of the same size, very stout, and the depth of the net ranges from 3 to 9 metres. Bamboo or wooden floats are attached to the head rope. The net is either shot in the middle of the river by an encircling movement of two boats and then hauled up into the boat after bringing the two ends of the foot rope together or one end is left on the shore and the other end is brought round enclosing a very large body of water after which the net is hauled in. When pieces of bamboo are tied across the net to facilitate the hauling operation, it is known as *tana ber jal*[1]. *Ber jal* is generally operated from October-November to May, when large numbers of spent and immature hilsa are caught. The net is not exclusive for hilsa, but this fish forms one of the primary catches.

[1] The *tana ber jal* is said to be 'a favourite net with the fishermen of Dacca, Faridpur and Kushtia in East Bengal' (Ahmad 1952).

In the large rivers like the Padma and the Meghna very long *ber jals* known as *jagat ber jal*, meaning universe enclosing net, over 1600 metres in length are used. The operation lasts for several days and a large variety of fish are caught. Though the *jagat ber jal* is not used primarily for hilsa, it also forms one of the catches.

Kona jal or *Bhesha gulli* (Fig. 5). This is a boat seine with a series of bags, each with a funnel-shaped pouch inside to prevent the escape of trapped fish, at intervals of 9 to 12 metres. The length of the net varies considerably from place to place and may be anything from about 30 to 300 metres. The number of bags also varies accordingly. The net is made of cotton and the mesh is about 5 cm. The mouth of the bags is rectangular in shape, 6 to 9 metres high and

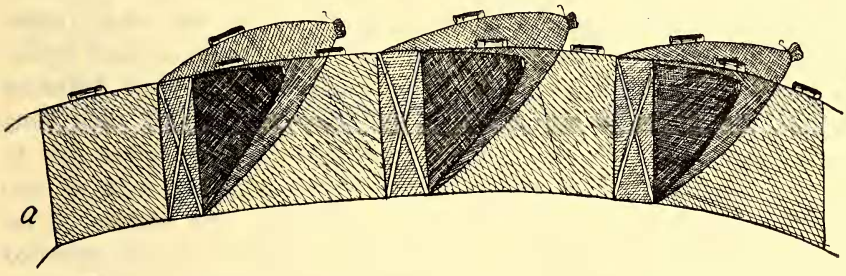

Fig. 5. A portion of *Kona jal* of Bengal

about 4 to 5 metres wide and the mesh is about 2.5 cm. The mouth of each bag is kept distended by two diagonally placed bamboo poles. The net is operated from two boats and the fish trapped in the bags are removed by untying the string at the cod end of each bag.

The net could be operated as a drag net from the shore or as a stake net by tying it to poles fixed in the river where there is strong current. The *kona jal* is generally used from May to October.

Fixed bag nets and stake nets

Behunti jal (Pl. V, fig. 6). The *behunti*, *behundi*, *bainti*, or *bim jal*, operated in the estuaries where the tidal influence is fairly strongly felt, is a multi-purpose net used for all fishes and prawns carried up and down the river by the current. Adult hilsa form only a negligible percentage of catches while in the middle reaches of the estuaries during the winter months large numbers of post-larval and juvenile hilsa are caught along with a variety of other fishes. As this net is of interest from the conservation point of view of the fishery and as no illustrated description is available it is described here.

This is a fixed bag net with a wide mouth, comparatively short wings and long cod end which is lashed with a string except when the catches have to be emptied. There is a flap on the inside near the cod end to prevent the fish from swimming out. The size of the net, the mesh opening, the thickness of the thread, etc. vary in different parts of Bengal. Those used in the lower reaches are larger while comparatively small sized ones are used in the upper zones. A typical one used in the Barrackpore-Nawabgunge area in which large quantities of juvenile hilsa are caught is shown in Plate V, figure 6.

Each wing is 9 metres and measures when fully stretched 26 metres from end to end with a mouth of 6 metres and a bag about 20 metres long. The mesh near the mouth is about 4 cm. but there is a progressive decrease in the size of the mesh opening towards the cod end where in some cases the netting will be substituted by hessian or thick canvas cloth. For fixing the net in the estuary either a pair of heavy wooden anchors are used or two stout wooden spikes are driven into the bed of the river with a specially devised 'battering ram'. A rope from the lower end of the extremity of each wing is fastened to them while a large drum is tied to the upper side to serve as a buoy. The mouth is kept open with the help of two bamboo poles each about 5 metres long. From the middle of the upper lip of the net to the cod end a thick draw rope is provided and sometimes a small empty kerosene tin or some other buoy is tied by a long rope to the cod end to facilitate the location of the cod end. Large quantities of post-larval and juvenile stages of hilsa are caught especially during the winter months.

The bag nets, *suti jal* and *bada jal* referred to in the Marketing Series No. 66 (Government of India, 1951) are evidently modifications of the *behunti jal*. They are made of cotton with about 1 cm. mesh and are comparatively much smaller in size and serve more or less as stake nets.

Suti jal (Fig. 8 *b*). Known as *soti jal* also, this is a funnel-shaped net 5 to 6 metres long with circumference at mouth about 5 metres and height of wing 1 to 1.5 metres. 'Leader wings extend from each side of the mouth and are supported on stakes. A stake passing through the centre of the mouth "anchors" the bag and serves also to keep the mouth distended. The head rope and the ground rope are tied to this stake. The posterior end of the bag is lashed with a string when in use. This net is set in river estuaries where there is a strong tidal action' (Marketing Series, op. cit.). According to Ahmad (1954) this net is common in the Rajshahi, Pabna, and Kushtia districts of East Bengal and are generally fixed in large numbers in the river side by side.

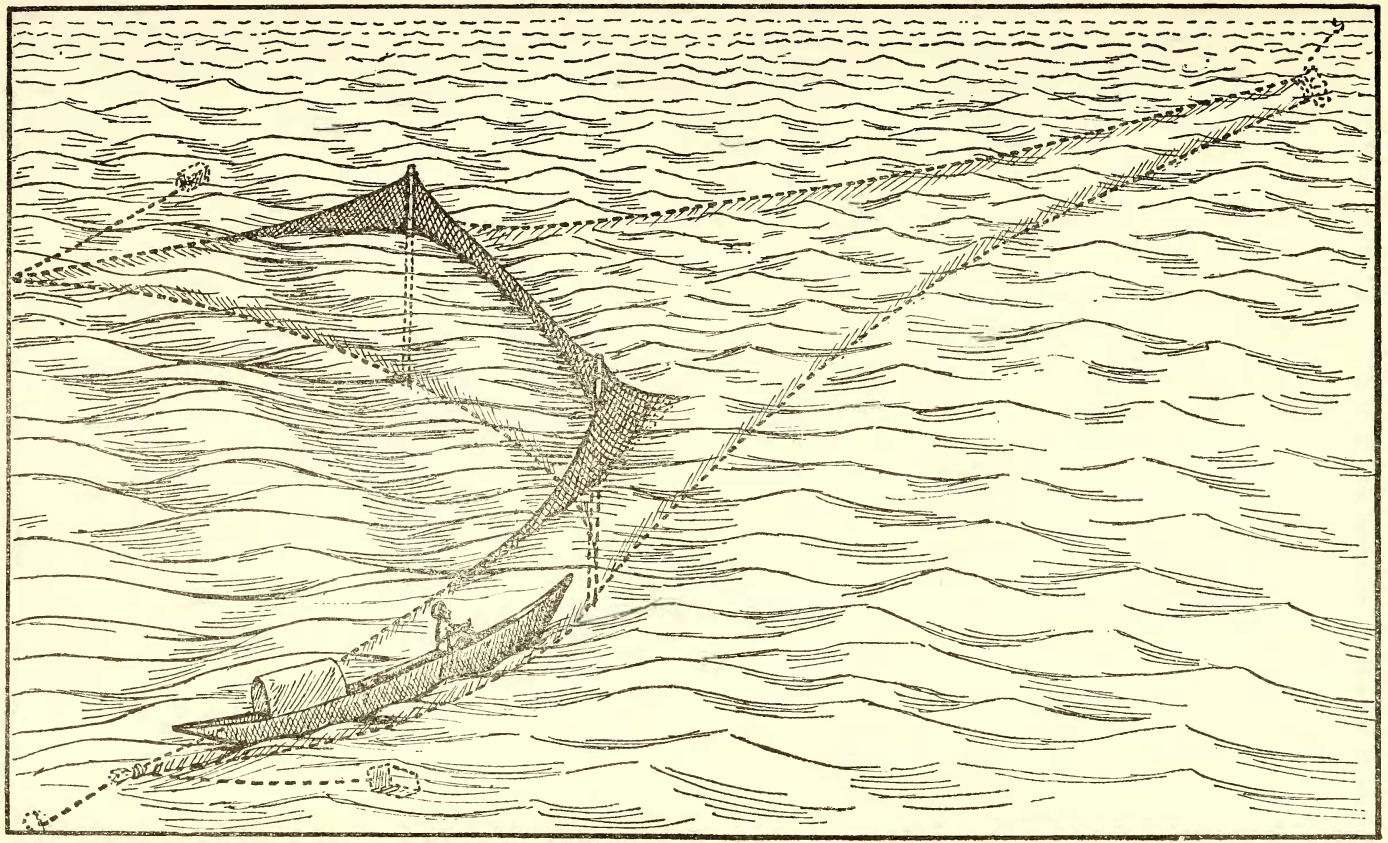

Fig. 6. *Behunti jal* of West Bengal. (By K. G. Nambiar)

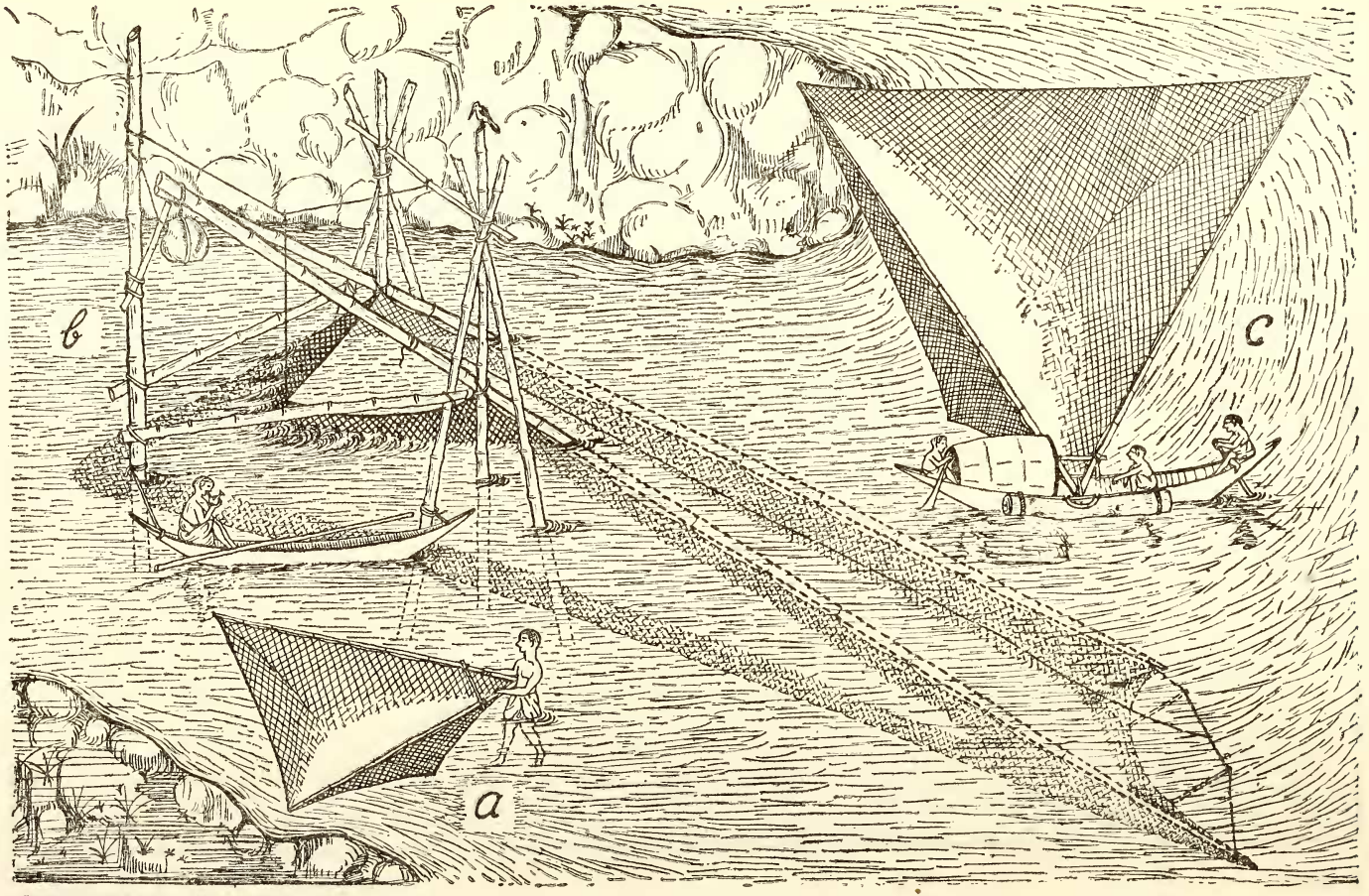

Fig. 7. a. *Hela jal* of West Bengal.
b. *Gara besal* or *gara jal* of West Bengal.
c. *Nauka besal* of West Bengal. (By M. Mydeen Kunju)

Bada jal. This is a bell-shaped net with a pouch inside, which serves as a trap. There are no leader wings but the mouth is very

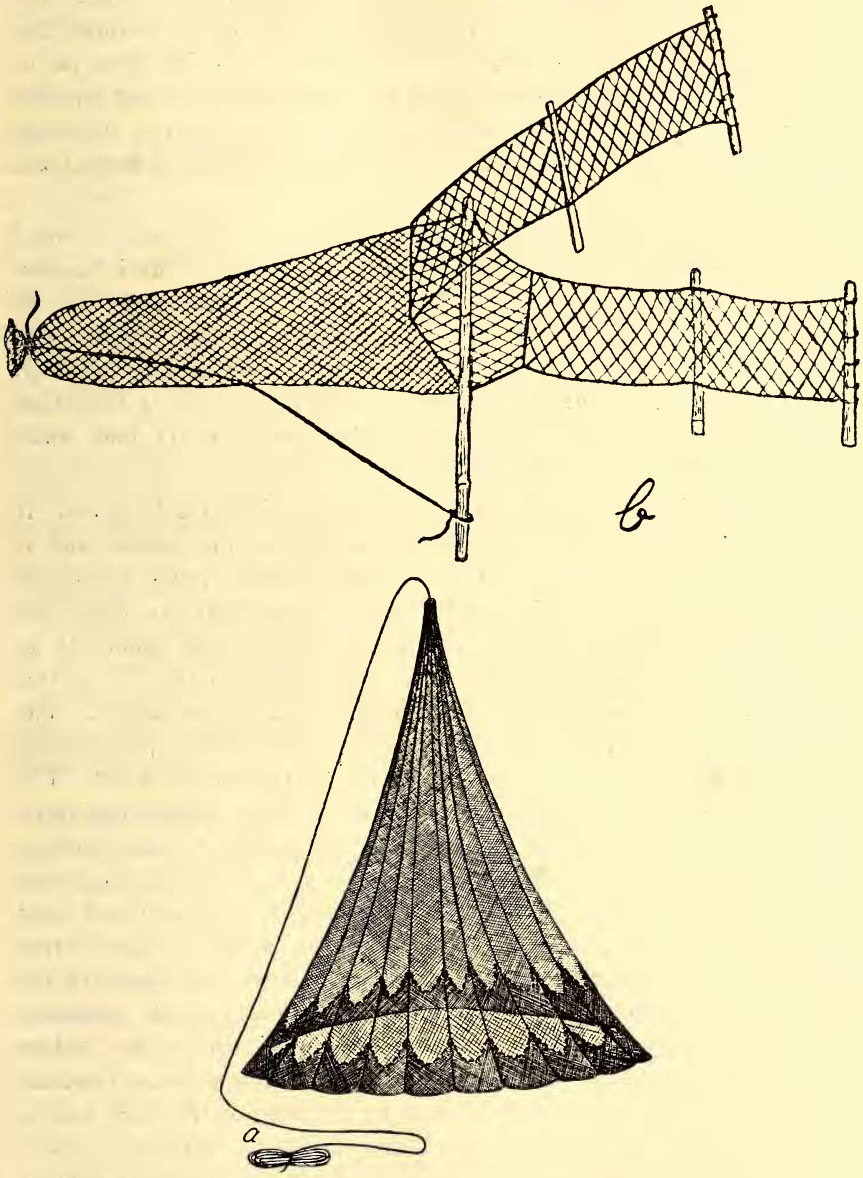

Fig. 8 a. *Kephla jal* of Bengal. (By M. P. Lakshmanan)
b. Diagram of *Suti jal* of Bengal. (After Ahmad 1954)

wide and is kept distended by two bamboo poles placed vertically on either side. A float is attached to the head rope. The net is tied to stakes, driven in the river and the wide posterior end is tied up by a string to form the cod end.

Lift nets

Lift nets are operated for all small and medium-sized surface and subsurface fishes and during certain seasons hilsa also constitutes one of the catches. The lift nets in use are the *bhasa jal, gara jal* or *gara besal*[1], and *nauka besal* or *basal jal.* All these are lever dip nets and would probably have evolved from the simpler type of hand-operated push net (Pl. VI, fig. 7 *a*) known as the *hela jal* in Bengal and *hadia jal* in Orissa.

Basa jal. This dip net is 3 to 4 metres in length and 1.5 to 2 metres in breadth, shaped like the segment of a circle, with a bamboo of about an inch in diameter on the arc side. I have never seen its operation, but Naidu (1939, p. 11) remarks: 'It is dipped into water 5 to 6 feet deep. Radius 6 to 8 feet supported by a *dingi.* Strings from all the three corners form as bridle and it is then held in hand in the manner of kite flying. Net has 1 to 1½ inch mesh mainly for hilsa and other surface fish'.

Gara besal or *gara jal* (Pl. VI, fig. 7 *b*). This is a fixed lever net. It is roughly triangular with considerable sagging in the middle and is tied to a V-shaped frame of two long bamboo poles connected distally by an apical cord. The net is connected to this cord by two short sticks. The size of the net varies from about 11 to 14 metres along the bamboo sides and about 8 to 11 metres across the cord. The mesh is about 4 cm. towards the middle. The V-shaped frame is worked on a horizontally kept bamboo pole serving as a fulcrum supported on posts fixed in the bed of the river. The two side posts are strengthened by two or three supporting posts depending on the size of the net and flow of water. A stout bamboo pole is planted vertically in a median position in line with the angle of the V-shaped frame. Horizontal cross bamboo poles are tied from the median post to the side post. A heavy stone or some other weight is tied to the angle of the frame to balance the weight of the frame on either side of the fulcrum and facilitate quick operation by a single person. A short moveable cross stick tied to the median pole serves as a 'catch' and keeps the net in position when lowered. A person who waits in a boat moored by the side of the fixed engine periodically gets up on the right horizontal cross bamboo, knocks off the 'catch', raises the net by pushing down the weighted portion and removes the fish after holding down the V-shaped frame with the left leg.

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[1] In the *gara besal* we could see a parallel of the Chinese dip net of the Far East, the *cheena vala* of the Travancore-Cochin back-waters and the *ndamtee* of the French Cameroons while the *nauka jal* is in principle similar to the *zemi* of the Kokoto tribe of Africa (Hornell 1950). *Besal* is also pronounced as *bheshal, beshal* and *veshal.*

The *gara besal* is generally fixed close to river banks where there is eddy formation. Sometimes artificial embankments are put up across creeks to create eddy and draw fish into it.

Nauka besal (Pl. VI, fig. 7 *c*). This net is similar to the previous one but comparatively smaller in size and worked from a boat, thereby increasing its range of operation. Each arm of the bamboo frame is 9 to 11 metres long with the arc about 6 metres across. The frame is worked on a short fulcrum supported on two posts fixed in the middle of the boat. A thick log of wood is tied outside the gunwale of the side opposite to the net to serve as a balancer. The distal portion of the net is wide meshed (2.5 to 4 cm.) while towards the apex it is close meshed (1.5 cm.). Usually 3 persons go about in a *besal* boat and of these one person is engaged in the operation of the net. The *besal* boat is 12 to 13 metres long, 1.3 to 1.6 metres broad, and a little over 60 cm. deep. The boat is provided with a hood of woven split bamboo or matting in a frame of semi-circular hoops of thin bamboo or rattan. A variety of surface and subsurface fishes including hilsa are caught in the *nauka besal*.

Cast nets

Ordinary cast nets known as *kephla jal* are used for hilsa in some of the smaller rivers like the Damodar and the Rypuarayan. In winter months a kind of large cast net known as the *batchari jal* is used by the fishermen to catch hilsa and other fishes from the Sundarban areas.

Kephla jal (Fig. 8 *a*). This is the ordinary cast net known by several other names in various parts of Bengal. The net is of the folding and puckering type with small cylindrical iron weights along the ground rope. From the apex to the periphery the net is about 5 metres long. It is made of 4 ply 40 count yarn with the mesh from .6 cm. to about 7 cm. Along the lower border (circumference), there are about 60 puckerings with 4 weights in each puckering. All the strings from the marginal zone converge to the centre where they are tied to a central cord 9 to 11 metres which passes through a ring forming the apex of the net.

Batchari jal or *othar jal*. This is a large-sized heavy cast net 15 to 23 metres in diameter and provided with puckerings and sinkers. Though exactly in the pattern of the *kephla jal*, it is not cast like that in view of its enormous size. It is paid out from a long narrow boat known as the *batchari nauka* having a complement of about 5 men. The net is first kept stretched on one side along the full length of the boat and dropped as the boat drifts with the current enclosing

a roughly circular space and as the apical cord tied to the centre of the boat gets taut by the drift of the boat, it is hauled up. The net is used for a variety of large-sized fishes, and hilsa which move about in shoals in the Sundarban estuaries during winter months are also caught. Generally a number of boats form a circle round a large shoal and operate the nets simultaneously so that those that try to escape from one get caught in another.

Barrier nets

Char-pata jal or *char-gherra jal* (Pl. VII, fig. 9). This net is used during the winter months in the foreshore areas of the eastern parts of the 24-Parganas where large areas get exposed during low tide. An operational net may be several hundreds of metres long depending on the strength of the participating fishermen. It is made up of a number of pieces each 7 to several metres long and 3 to 4 metres wide. The dimensions as well as the structure of the net vary considerably. It may either be of cotton or hemp or jute and sometimes a combination of any of these in which case the lower half is generally of cotton yarn. The upper portion is wide-meshed (about 5 cm.) while the lower portion is of about 1.3 cm. mesh. When made of cotton it is usually of 10 to 16 ply of No. 10 count. The ground rope is of stout jute, while the head rope is slender.

A series of poles are fixed firmly in the mud just above the low-water line sometimes extending over 1600 metres. The stout ground rope of the net is tied to the base of the poles and the whole net is left flush with the ground, with strings from the head rope attached to the top of the poles here and there to enable the net to be raised when required. At the peak of the high tide the fishermen go about in boats and raise the head rope and fix it on the poles above the water line. When the water starts receding the net forms an effective barrier preventing the escape of any fish that has moved into the flooded area. The stranded fish are collected and the process is repeated.

The net is operated especially during spring tides in the winter months when large numbers of fishermen congregate in the lower reaches of the Gangetic delta for fishing purposes. A variety of fishes are caught in the net and generally hilsa forms one of the important catches.

Mal jalo (Pl. X, fig. 12). It is reported that this net is operated on the Midnapore Coast in West Bengal where there is a wide tidal zone. It is more common along the Balasore Coast and a typical one in use in Chandipore is described under Orissa (p. 268).

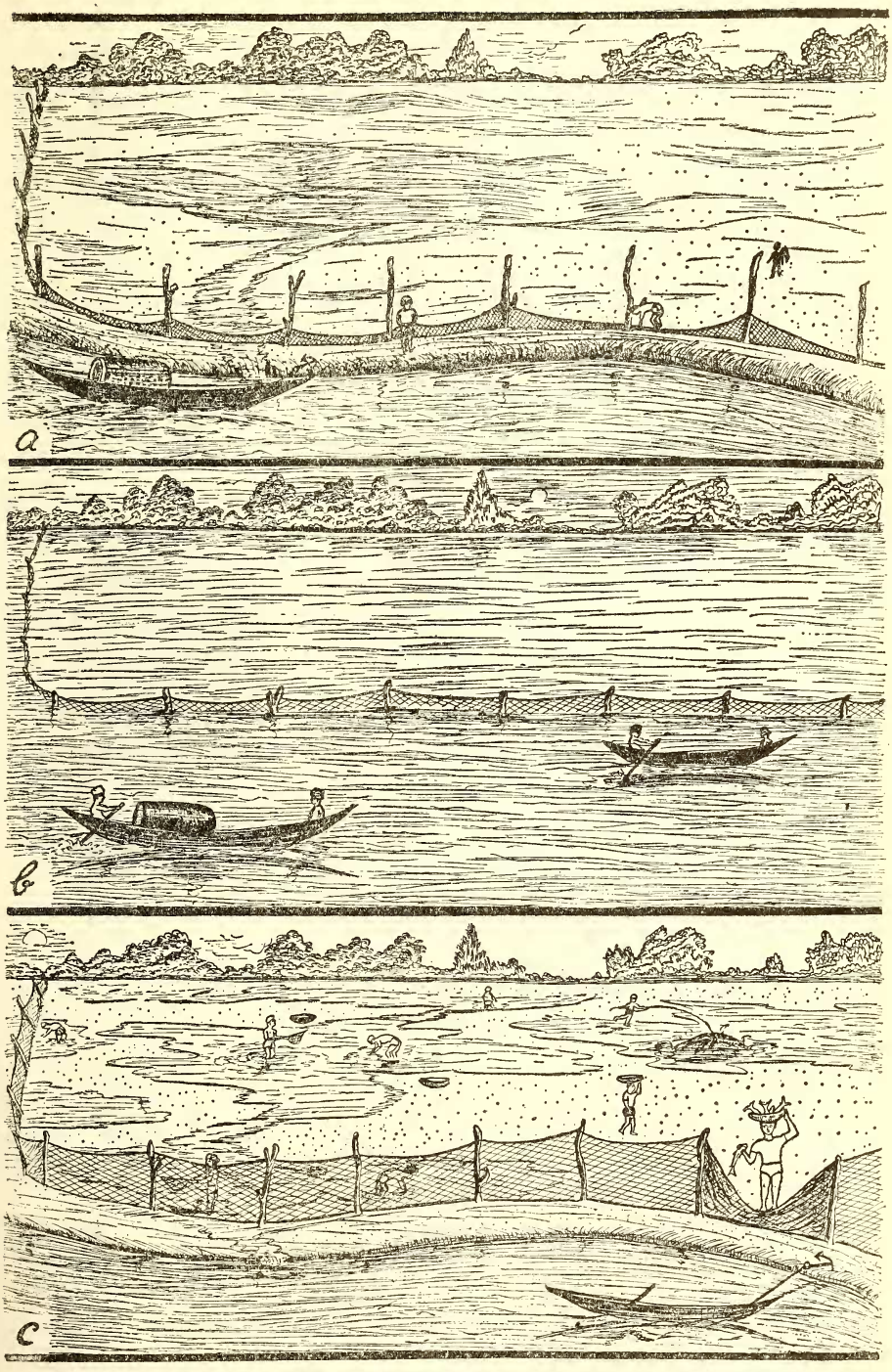

Fig. 9. Operation of the *Char-gherra jal* of Bengal. (By M. P. Lakshmanan)
a. Beginning of the operation—fixing up of the net during low tide.
b. Head rope raised and fixed on the poles at the height of the tide.
c. Fishing operation after the recedence of water.

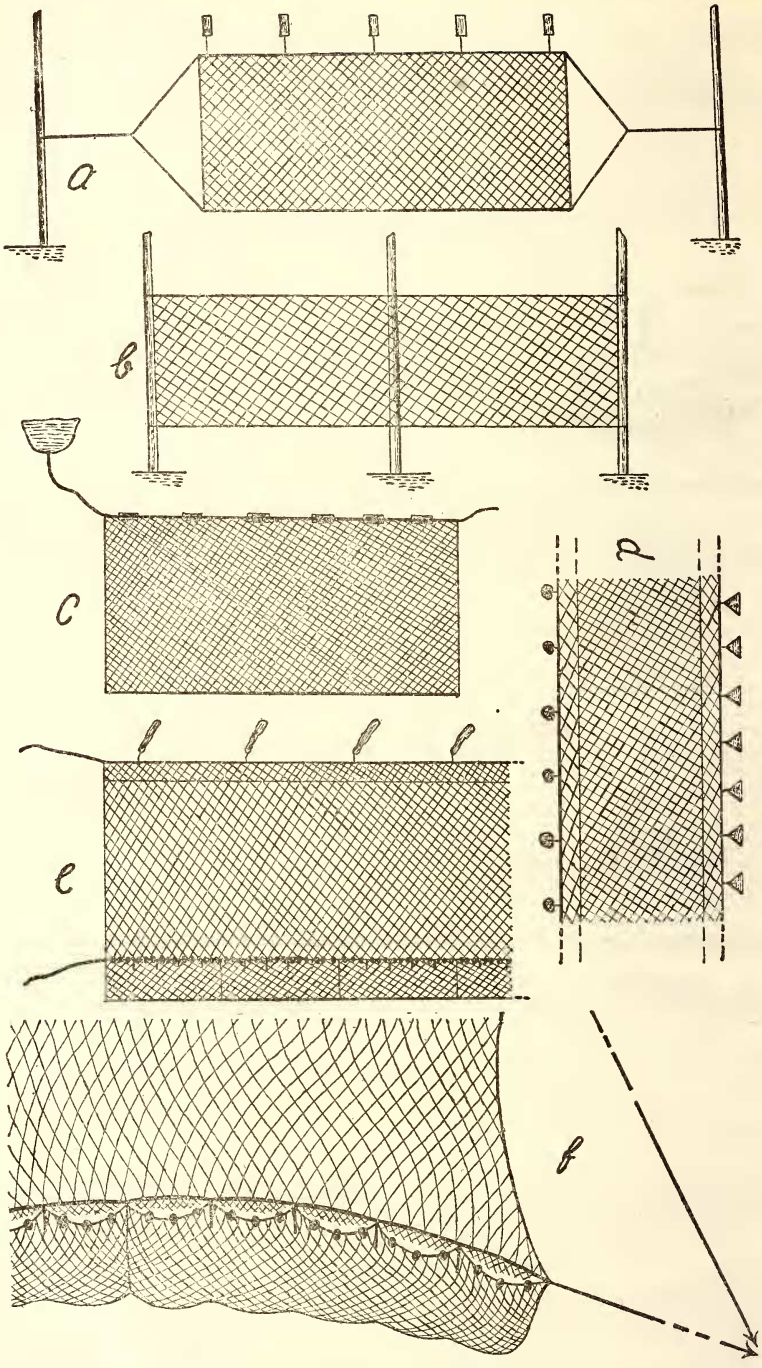

Fig. 10. a. *Ilishi phandi jalo* of Orissa.
b. *Tisto jalo* of Orissa.
c. *Chondi jalo* of Chandipore (Orissa).
d. *Bar jalo* of Chandipore (Orissa).
e. A portion of *Tangra jalo* of Orissa.
f. A portion of *Tangra jalo* in stretched condition at the time of hauling. (All by M. Kumaran)

2. Orissa[1]

Hilsa is available in all the rivers and estuaries of the State from the Subharnarekha in the north to the Chilka Lake and the Rishikulya estuary in the south. During the winter months there is a fishery in the shallow coastal waters also. As the largest river in the State, viz. the Mahanadi, is spanned by anicuts at Naraj and Cuttack there is no hilsa fishery above the anicuts.

Since the State is contiguous to West Bengal much of the fishing gear used is similar with slight modifications and known under different local names, Hilsa is known in Oriya as *ilishi* and more than one net primarily intended for this fish go under the name *ilishi jalo*. The suffix *jalo* is derived from the word *jal* in Hindi and Bengali and means net. Along the Ganjam coast in south Orissa where the sea-going fishermen are all Telugus, the word *jalo* is replaced by *vala*.

Gill nets

Ilishi phandi jalo or *ilishi jalo* (Pl. VIII, fig. 10 *a*). This is a fixed gill net operated in the rivers and estuaries in Balasore District from the middle of October to the middle of March. Each piece is about 15 metres long and 5 metres broad and two or more of such pieces joined together make one composite operational unit. It is made of either 6 ply 10 counts or 8 ply 20 counts yarn or hemp. The head rope has bamboo floats 75 cm. in length about 4 metres apart. The head rope and the ground rope are joined at one side and two ropes each about 11 metres long tied to two poles on either side help to hold the net in a stretched condition. A boat with a crew of 2 men goes about collecting the gilled fish which mainly consist of hilsa.

There is another net of larger mesh called the *bhekti phandi jalo* fixed in the sea and estuaries for large-sized fishes, such as *Lates* (bhekti), sciaenids, etc. Occasionally hilsa is also caught in this net. It is otherwise known as *bar jalo* or *bara jalo* also.

Tisto jalo (Pl. VIII, fig. 10 *b*). This is a very simple type of fixed gill net without floats or sinkers used in the tidal region of the foreshore areas in Balasore District from the middle of March to the middle of July. It has 10 cm. mesh and is made of 6 ply 20 counts yarn or of hemp. Each piece is 18 to 27 metres long, 1.4 metres broad, and

[1] Information on *bhasani jalo* and *bhiro jalo* has been collected and furnished by Mr. Ajit Banerjee of the Central Inland Fisheries Research Station. I am indebted to the late Shri Mukhram, Survey Assistant, Central Marine Fisheries Research Station, for information on other gill nets, trawl nets and drag nets recorded from Chandipore and Ganjam, Orissa.

3 to 5 such pieces are joined together lengthwise to make one operational net. It is tied during low tide to sal wood stakes fixed about 9 metres apart about 400 metres from the shore. During the high tide water rises above the net and the fish that get gilled are removed during the low tide. No boats are used for the operation of the *tisto jalo*.

Ilishi jalo. This is also a simple type of fixed gill net consisting of a rectangular piece of netting similar to the *ilishi phandi jalo*, 36 metres or more long and 4.5 to 5.5 metres broad with 7 to 10 cm. mesh. The head rope and the ground rope which are without floats or sinkers are tied to 2 poles fixed in the estuary. It is mainly intended for hilsa but other clupeoids also get gilled.

Basani jalo. This is a gill net operated along the Balasore coast mainly for hilsa from a single boat by 2 or 3 persons. It is made of 8 ply 16 counts or 10 ply 20 counts yarn or hemp with 4 to 7 cm. mesh. Total length of the net depends on the number of pieces used and may sometimes be up to 460 metres long. Each piece is about 38 metres long and 4.5 metres broad. The head rope has wooden floats 4.5 metres apart of which the first one is large and conspicuous and serves as a buoy and the ground rope has small iron sinkers.

The net is taken in a boat with a crew of 3 or 4 persons and when a shoal is sighted it is cast quickly around the shoal. When the buoy is contacted on the completion of the encircling movement, the two ends of the net are brought together and it is hauled into the boat removing the gilled fish as they come in. The net is operated from November to February and along with hilsa other fishes such as *Lates*, sciaenids, catfishes, engraulids, mullets, etc. are also caught.

Chondi jalo (Pl. VIII, fig. 10 *c*). This is a long narrow drift net similar to the *chondi jal* of Bengal. The net may be up to 370 metres long and it is 1.2 metres broad with 5 to 10 cm. mesh. There are floats on the head rope of which the one at the end is large and conspicuous and serves as a buoy. The ground rope has no sinkers. The net is held on to the boat by a long rope and is allowed to drift with the current. It is used in rivers, estuaries, and the sea. In the Dhamra and Mahanadi estuaries this is reported to be used practically all round the year except during very rough weather. Fishes other than hilsa are also caught in the net. It is used as a drag-net during the fish drives in the Mahanadi as described elsewhere (p. 269).

Bhiro jalo or *bheed jalo* or *ilishi jalo*. This is said to be a modification of the *ilishi jalo* and the *ilishi phandi jalo* with wooden floats and earthen sinkers and is operated from 2 boats. The net is

made of 6 ply 10 counts yarn with 10 cm. mesh and may be 200 metres to over 600 metres long, composed of a number of pieces 18 metres long and 5.5 to 9 metres broad contributed by the participating fishermen. The net is operated along the Balasore coast from November to March.

Two large boats, each carrying a *bhiro jalo* with a crew of 6 to 10 persons scout for hilsa shoals along the foreshore waters beyond the tidal zone. On sighting a shoal, the two boats come together, join the two nets, and make an encircling movement while paying out the net. As the two boats meet the two ends of the combined net are held together in one boat and the other boat goes inside the encircled area while the men frighten the shoal by making noise and beating the water with poles. Due to the disturbance caused, the fish scatter in all directions to get gilled in the encircling wall of net. When it is felt that very few fish are left uncaught each boat reverses the operation by hauling the net and stacking it for the next operation after the gilled fish are removed.

The above net known locally as the *bhido jalo* or *bhida jalo* is a multi-purpose gill net made of yarn or hemp used in the Chilka Lake for catching all kinds of fishes including hilsa. Each piece is about 9 metres long and about 3 metres broad with 4 to 5 cm. mesh and wooden floats 60 to 90 cm. apart along the head rope. A hundred or more pieces are joined together and loaded in two boats and cast as the *bhiro jalo*. 3 or 4 accompanying boats race into the encircled area just before the opening closes making a great deal of noise and disturbance in the water. The fish scatter in all directions and get gilled.

Gherua jalo. This is a hempen gill net similar to the *bhido jalo* used in the Chilka Lake for all kinds of fishes including hilsa.

Odi vala or *odi jalo*. This is a multi-purpose drift net used in the sea along the Ganjam coast (South Orissa) by Telugu fishermen. It is made of a single piece of netting about 60 metres long and 12 metres broad with 7 to 10 cm. mesh. It is operated from a catamaran with a crew of 2 men who allow the whole net to drift at the end of a rope about 73 metres long. The net is used from May to September and a variety of fishes including hilsa are caught.

Pelagic Trawl

Iriga vala or *irgali* or *irgal jalo* (Pl. IX, fig. 11 *a*, *b*). This is a conical bag-net resembling the *thurivalai* of the Coromandel coast (Hornell 1924 *b*). This is operated by Telugu fishermen in the sea along the Ganjam coast in south Orissa. The net is made in two sizes and the larger one is known as the *pedda irgali* or *bada irgali* and the

smaller one is known as the *sanna irgali* or *chotta irgali*. The former has a bag length of 13 metres and wing span of 27 metres on each side while the latter has a bag length of 7 metres and wing span of 15 metres on each side. Except in the difference in size both are alike in construction and mesh size. The cod end of the net has an opening for emptying the contents which is kept tied with a stout rope with a stone weight at the end to keep the net at the proper level during operation. The head rope has floats and the ground rope sinkers. A typical *pedda irgali* is figured indicating the different portions like *baromadi*, *male madi*, *sinapu vala*, *ata vala*, *waram* with the respective mesh sizes.

Two catamarans each with a crew of 2 persons proceed to the fishing ground with the net loaded in one if it is a *sanna irgali* or in both if it is a *pedda irgali*. On reaching the fishing ground which may be 2400 to 6000 metres away from the shore the bag is let down into the water and the catamarans move away from one another and in a forward direction holding the two wing ropes and stretching the net to the maximum extent. The catamarans again meet together bagging all the fish covered by the wings. The net is then quickly hauled in and the fish caught are removed. Hilsa forms one of the catches.

Often when a large shoal is sighted two nets are operated from opposite directions encircling it and the nets are then hauled into the respective catamarans.

Drag nets

Bar jalo (Pl. VIII, fig. 10 *d*). This is a very long multi-purpose drag net sometimes over 300 metres long depending on the number of pieces laced together. Each piece is about 18 metres long and 3 to 9 metres broad, made of yarn or hemp. The mesh varies from 5 to 9 cm. It has wooden floats and sinkers of burnt clay.

The net is loaded into a boat and a long rope tied to one end of the net is held by a party on the shore. The boat is rowed far out making a semi-circle and covering the maximum area possible. When it reaches the shore most of the crew leave the boat holding the rope at the other end of the net and both the parties haul it in the manner of a typical shore seine landing all fishes in the body of water covered by the net.

Fishing with this net is carried out during the winter months from November to March when the sea is comparatively calm.

Tangra jalo or *tangna jalo* or *tangni jalo* (Pl. VIII, figs. 10 *e*, *f*). This is a multi-purpose pocketed drag net, like the *ghai ber jal* of Bengal, operated in rivers and estuaries in Balasore district. The main body

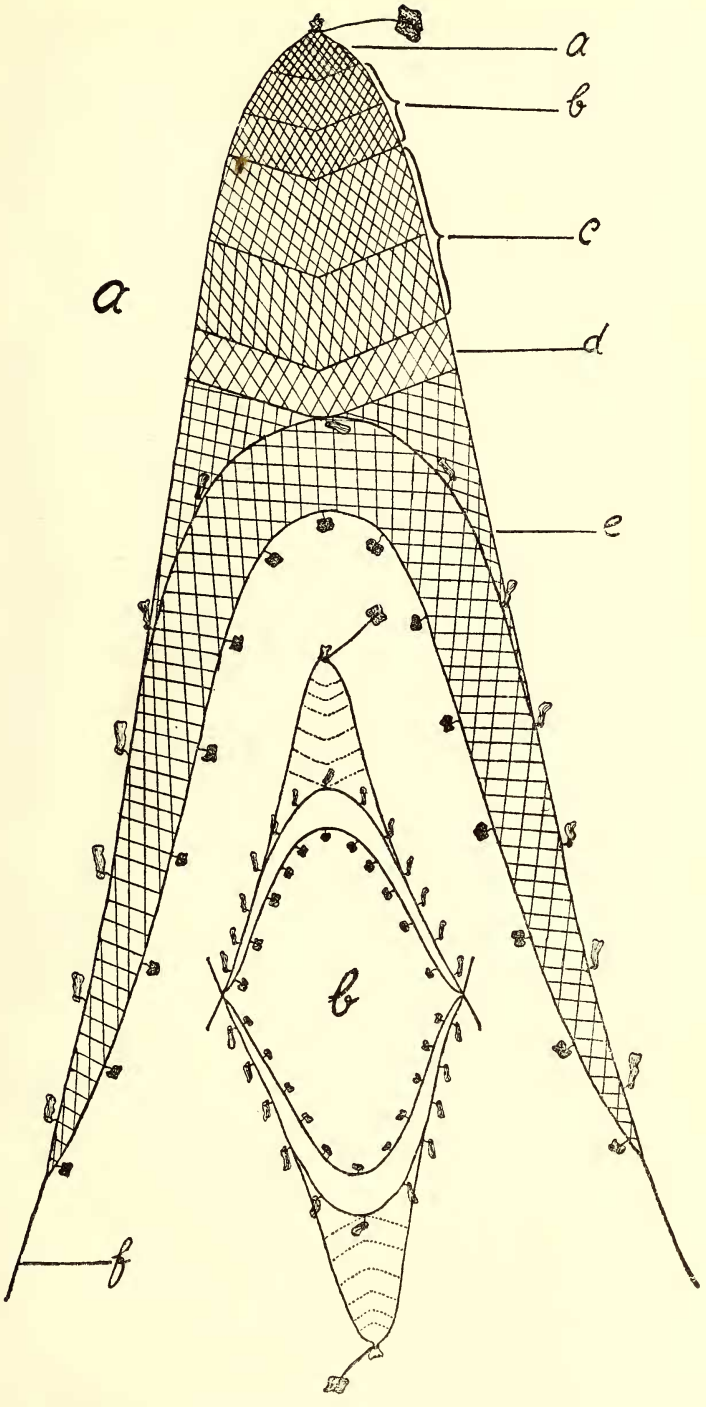

Fig. 11. a. *Iriga vala* or *irgali* of S. Orissa and Andhra.
b. Diagram showing the operation of two *Iriga valai* from opposite directions. (By M. Kumaran)
a = Baromadi ; b = Malemadi ; c = Sinapu vala ; d = Ata vala ; e = Waram ; f = Thradu.